

**WEST****Freeform Search****Database:**

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Set Name  
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Query
Hit Count    Set Name  
                  result set
*DB=USPT; PLUR=YES; OP=OR*L37    5406493.pn.1    L37L36    5592665.pn.1    L36L35    5754846.pn.1    L35*DB=USPT,PGPB,JPAB,EPAB,DWPI,TDBD; PLUR=YES; OP=OR*L34    14 and peano or kd-tree34    L34L33    14 and kd-tree0    L33L32    14 and kd-tree0    L32L31    14 and kd-tree or peano near tree0    L31*DB=USPT; PLUR=YES; OP=OR*L30    4773026.pn.1    L30L29    5031104.pn.1    L29

<u>L28</u>	5036471.pn.	1	<u>L28</u>
<u>L27</u>	5168452.pn.	1	<u>L27</u>
<u>L26</u>	5272638.pn.	1	<u>L26</u>
<u>L25</u>	5285391.pn.	1	<u>L25</u>
<u>L24</u>	5513110.pn.	1	<u>L24</u>
<u>L23</u>	5602564.pn.	1	<u>L23</u>
<u>L22</u>	5628050.pn.	1	<u>L22</u>
<u>L21</u>	5867110.pn.	1	<u>L21</u>
<u>L20</u>	5893901.pn.	1	<u>L20</u>
<u>L19</u>	5231584.pn.	1	<u>L19</u>
<u>L18</u>	5966135.pn.	1	<u>L18</u>
<u>L17</u>	6016485.pn.	1	<u>L17</u>
<u>L16</u>	5978730.pn.	1	<u>L16</u>
<u>L15</u>	6016485.pn.	1	<u>L15</u>
<u>L14</u>	5185161.pn.	1	<u>L14</u>
<u>L13</u>	5398188.pn.	1	<u>L13</u>
<u>L12</u>	5434591.pn.	1	<u>L12</u>
<u>L11</u>	5471392.pn.	1	<u>L11</u>
<u>L10</u>	5613055.pn.	1	<u>L10</u>
<u>L9</u>	5614898.pn.	1	<u>L9</u>
<u>L8</u>	6144318.pn.	1	<u>L8</u>
<u>L7</u>	6173232.pn.	1	<u>L7</u>
<u>L6</u>	6202026.pn.	1	<u>L6</u>

*DB=USPT,PGPB,JPAB,EPAB,DWPI,TDBD; PLUR=YES; OP=OR*

<u>L5</u>	L4 and kd-tree or peano	125	<u>L5</u>
<u>L4</u>	L2 and sub-areas or subareas	1160	<u>L4</u>
<u>L3</u>	L2 and (sub-areas or subareas)	3	<u>L3</u>
<u>L2</u>	L1 and parcel	213	<u>L2</u>
<u>L1</u>	map and database	18067	<u>L1</u>

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Logout

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Edit S Numbers

Preferences

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result set

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DB=USPT; PLUR=YES; OP=OR

L30 4773026.pn.1 L30L29 5031104.pn.1 L29

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<u>L8</u>	6144318.pn.	1	<u>L8</u>
<u>L7</u>	6173232.pn.	1	<u>L7</u>
<u>L6</u>	6202026.pn.	1	<u>L6</u>

*DB=USPT,PGPB,JPAB,EPAB,DWPI,TDBD; PLUR=YES; OP=OR*

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<u>L4</u>	L2 and sub-areas or subareas	1160	<u>L4</u>
<u>L3</u>	L2 and (sub-areas or subareas)	3	<u>L3</u>
<u>L2</u>	L1 and parcel	213	<u>L2</u>
<u>L1</u>	map and database	18067	<u>L1</u>

END OF SEARCH HISTORY

**WEST**

## End of Result Set

09/01/6002

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Generate Collection

Print

L24: Entry 1 of 1

File: USPT

Apr 30, 1996

US-PAT-NO: 5513110

DOCUMENT-IDENTIFIER: US 5513110 A

TITLE: Navigation system and path search method using hierarchized road data

DATE-ISSUED: April 30, 1996

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Fujita; Takehiro	Kokubunji			JPX
Nomura; Takashi	Chigasaki			JPX

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Xanavi Informatics Corporation	Zama			JPX	03
Hitachi, Ltd.	Tokyo			JPX	03

APPL-NO: 8/ 272493 [PALM]

DATE FILED: July 8, 1994

## FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	5-170643	July 9, 1993

INT-CL: [6] G06 F 165/00

US-CL-ISSUED: 364/449; 364/444, 340/990, 340/995

US-CL-CURRENT: 701/207; 340/990, 340/995, 701/201

FIELD-OF-SEARCH: 364/443, 364/444, 364/449, 73/178R, 340/988, 340/990, 340/995

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected

Search ALL

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<input type="checkbox"/>	<u>4716404</u>	December 1987	Tabata et al.	340/995
<input type="checkbox"/>	<u>4984168</u>	January 1991	Neukrichner et al.	340/995
<input type="checkbox"/>	<u>5031104</u>	July 1991	Ikeda et al.	364/449
<input type="checkbox"/>	<u>5036471</u>	July 1991	Tamura et al.	364/449
<input type="checkbox"/>	<u>5168452</u>	December 1992	Yamada et al.	364/444
<input type="checkbox"/>	<u>5272638</u>	December 1993	Martin et al.	364/444
<input type="checkbox"/>	<u>5285391</u>	February 1994	Smith, Jr. et al.	364/443

## FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0372840A3	June 1990	EPX	
0575943A1	December 1993	EPX	
4212884A1	October 1992	DEX	
1-219610	September 1989	JPX	
2-306400	December 1990	JPX	
3-188316	August 1991	JPX	
3230299	October 1991	JPX	
4-204168	July 1992	JPX	
WO93/03452	February 1993	WOX	

## OTHER PUBLICATIONS

Niwa et al., "Path Finding Algorithm Based on the Hierarchical Representation of a Road Map and its Application to a Map Information System," Bulletin of the Japan Institute of Information Processing, 32:5, 659-999, May 1990.

Kato et al., "An Intelligent Route Search Method through Accessibility Index," Resume for the 45th National Meeting of Japan Institute of Information Processing, 6N-2:1, 413-414, Oct. 11-14.

Kato et al., "The Comparison among the Route Search Methods for the Nationwide Road Networks of Japan," Resume for the 46th National Meeting of Japan Institute of Information Processing, 8Q-2:1, 381-382, Mar. 23-26, 1993.

Kato et al., "A Route Search Method Restricting the Search Area by the Particular Meshes for the Nationwide Road Networks of Japan," Resume for the 46th National Meeting of Japan Institute of Information Processing, 8Q-2:1, 383-384, Mar. 23-26, 1993.

ART-UNIT: 234

PRIMARY-EXAMINER: Chin; Gary

ATTY-AGENT-FIRM: Pennie &amp; Edmonds

## ABSTRACT:

A navigation system in which a more preferable path can be quickly searched for by using map data in a form easy of maintenance, and which is well suited for installation on a vehicle. A map data memory unit stores therein the road data of roads which belong to management areas, for each of the management areas of predetermined extent and shape and for each of hierarchies corresponding to sorts of the roads. A path search/guidance control unit searches for the path which extends from a current point decided by a positioning unit, to a destination point set by a set input unit. The path search is made in such a way that nodes connecting with the roads in higher hierarchies and paths extending to the nodes are searched for from the current point and from the destination point, sequentially in the respective hierarchies from the hierarchies corresponding to the current point and the destination point up to the hierarchy corresponding to a distance between the point of departure and the destination point, the connecting nodes and the extending paths

being searched for as to each of the respective hierarchies and on the basis of the road data of the pertinent hierarchy relevant to the management areas which lie within limits of a size corresponding to the pertinent hierarchy, and that a path is searched for between the nodes which have been searched for and which connect with the roads in the hierarchy corresponding to the distance between the point of departure and the destination point. Further, the path search/guidance control unit gives a guidance suggestion on a display unit through a display control unit.

6 Claims, 30 Drawing figures

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L19: Entry 7 of 17

File: USPT

May 2, 2000

US-PAT-NO: 6058390

DOCUMENT-IDENTIFIER: US 6058390 A

TITLE: Vehicle navigation assistance device having fast file access capability

DATE-ISSUED: May 2, 2000

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Liaw; Jeff Jyh-Min	San Jose	CA		
Sakakibara; Toshikazu	Cupertino	CA		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Visteon Technologies, LLC	Sunnyvale	CA			02

APPL-NO: 8/ 753483 [PALM]

DATE FILED: November 26, 1996

INT-CL: [7] G06 F 17/30

US-CL-ISSUED: 707/2; 707/100, 340/995

US-CL-CURRENT: 707/2; 340/995, 707/100

FIELD-OF-SEARCH: 340/995, 340/990, 707/1-10, 707/205, 707/3, 707/204, 707/100-102, 364/443

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected

Search ALL



PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/> <u>4571700</u>	February 1986	Emry, Jr. et al.	707/101
<input type="checkbox"/> <u>4888698</u>	December 1989	Driessen et al.	364/443
<input type="checkbox"/> <u>5305295</u>	April 1994	Chu	369/30
<input type="checkbox"/> <u>5307278</u>	April 1994	Hermans et al.	364/450
<input type="checkbox"/> <u>5375233</u>	December 1994	Kimber et al.	707/205
<input type="checkbox"/> <u>5471393</u>	November 1995	Bolger	364/450
<input type="checkbox"/> <u>5515283</u>	May 1996	Desai et al.	364/443
<input type="checkbox"/> <u>5560006</u>	September 1996	Layden et al.	707/2
<input type="checkbox"/> <u>5678046</u>	October 1997	Cahill et al.	707/200
<input type="checkbox"/> <u>5778374</u>	July 1998	Dang et al.	707/101

## FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0354645 A3	May 1989	EPX	

## OTHER PUBLICATIONS

"Microsoft Press Computer Dictionary," Microsoft Press, Second Edition, p. 241, Dec. 1994.

ART-UNIT: 271

PRIMARY-EXAMINER: Alam; Hosain T.

ATTY-AGENT-FIRM: Blakely, Sokoloff, Taylor & Zafman LLP

## ABSTRACT:

A method of using a DOS file system to access a file in a database is provided. In one embodiment implemented in an on-board vehicle navigation system, the file includes map data for a given geographic area. A file access table (FAT) is associated with the file system and references the file. The FAT has a plurality of locations, each location including a reference to one of the data clusters of the file and to another location in the FAT, forming a linked list of the references. The logical order in which the data clusters occur within the file is determined by following the linked list in the FAT for that file. A cluster table is then constructed for the file. The references to the data clusters are stored in consecutive locations of the cluster table according to the logical order of the data clusters within the file. The file is then accessed by sequentially accessing the consecutive locations in the cluster table to retrieve the data clusters.

18 Claims, 9 Drawing figures

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L28: Entry 1 of 2

File: USPT

Aug 18, 1998

US-PAT-NO: 5797112

DOCUMENT-IDENTIFIER: US 5797112 A

TITLE: Navigation apparatus using a position index and information representative of roads and institutions

DATE-ISSUED: August 18, 1998

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Komatsu; Takako	Tokyo			JPX
Muraki; Kazunori	Tokyo			JPX

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
NEC Corporation	Tokyo			JPX	03

APPL-NO: 8/ 531444 [PALM]

DATE FILED: September 21, 1995

## FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	6-226410	September 21, 1994

INT-CL: [6] G01 C 21/00, G01 L 3/00

US-CL-ISSUED: 701/201; 395/12, 701/208

US-CL-CURRENT: 701/201; 701/208, 706/11

FIELD-OF-SEARCH: 364/443, 364/444.1, 364/444.2, 364/449.1, 364/449.2, 364/449.3, 395/2.4, 395/2.6, 395/2.66, 395/2.84, 395/12, 701/200, 701/201, 701/202, 701/207, 701/208, 701/209, 701/211

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

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<input type="checkbox"/>	<u>5041983</u>	August 1991	Nakahara et al.	364/449.3
<input type="checkbox"/>	<u>5177685</u>	January 1993	Davis et al.	364/443
<input type="checkbox"/>	<u>5191532</u>	March 1993	Moroto et al.	364/444.1
<input type="checkbox"/>	<u>5214707</u>	May 1993	Fujimoto et al.	395/2.84
<input type="checkbox"/>	<u>5272638</u>	December 1993	Martin et al.	364/444.2
<input type="checkbox"/>	<u>5274560</u>	December 1993	LaRue	364/444.2
<input type="checkbox"/>	<u>5524169</u>	June 1996	Cohen et al.	395/2.4
<input type="checkbox"/>	<u>5544061</u>	August 1996	Morimoto et al.	364/444.2

## FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0 346 483	December 1989	EPX	
59-105113	June 1984	JPX	
61-118834	June 1986	JPX	
62-108111	May 1987	JPX	
63-163210	July 1988	JPX	
2-176868	July 1990	JPX	
3-039106	April 1991	JPX	
3-257485	November 1991	JPX	
3-282802	December 1991	JPX	
WO 92/009866	November 1992	WOX	

ART-UNIT: 364

PRIMARY-EXAMINER: Zanelli; Michael

ASSISTANT-EXAMINER: Pipala; Edward

ATTY-AGENT-FIRM: Foley &amp; Lardner

## ABSTRACT:

A moving object navigation apparatus includes an input section, a map information memory section, a database, a coordinate retrieval section, a route calculation section, and an output section. The input section inputs institution names indicating the present location of a moving object and a destination by using a natural language. The map information memory section stores a map including information of roads and institutions. The database stores the relationship between the institution names on the map stored in the memory and position indexes. The coordinate retrieval section retrieves the institution names indicating the present location and the destination, which are input by the input section, from the database, and outputs corresponding position indexes. The route calculation section obtains the shortest route between the position indexes of the present location and the destination, which are output from the coordinate retrieval section, by referring to the map stored in the memory. The output section outputs route information obtained by the calculation section to the user of the moving object.

7 Claims, 9 Drawing figures

**WEST****End of Result Set**☐

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L21: Entry 1 of 1

File: USPT

Feb 2, 1999

US-PAT-NO: 5867110

DOCUMENT-IDENTIFIER: US 5867110 A

TITLE: Information reporting system

DATE-ISSUED: February 2, 1999

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Naito; Akira	Fujisawa			JPX
Shimizu; Hiroshi	Yokohama			JPX
Akamatsu; Chiyo	Yokohama			JPX
Nozoe; Takahiko	Yokohama			JPX

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Hitachi, Ltd.	Tokyo			JPX	03

APPL-NO: 8/ 696028 [PALM]

DATE FILED: August 9, 1996

## FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	7-205989	August 11, 1995

INT-CL: [6] G08 G 1/123

US-CL-ISSUED: 340/995; 340/988, 340/990, 701/201, 701/209, 701/211

US-CL-CURRENT: 340/995; 340/988, 340/990, 701/201, 701/209, 701/211

FIELD-OF-SEARCH: 340/995, 340/988, 340/990, 364/443, 364/449.6, 364/449.1, 701/201, 701/209, 701/211

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

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<input type="checkbox"/>	<u>4359733</u>	November 1982	O'Neill	342/36
<input type="checkbox"/>	<u>4608656</u>	August 1986	Tanaka et al.	364/449.6
<input type="checkbox"/>	<u>5122959</u>	June 1992	Nathanson et al.	364/436
<input type="checkbox"/>	<u>5170353</u>	December 1992	Verstraete	364/444
<input type="checkbox"/>	<u>5272638</u>	December 1993	Martin et al.	364/444
<input type="checkbox"/>	<u>5513110</u>	April 1996	Fujita et al.	364/449.1
<input type="checkbox"/>	<u>5543789</u>	August 1996	Behr et al.	340/995
<input type="checkbox"/>	<u>5602564</u>	February 1997	Iwamura et al.	345/119
<input type="checkbox"/>	<u>5628050</u>	May 1997	McGraw et al.	455/12.1

## FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
4-295995A	October 1992	JPX	
5-327604A	December 1993	JPX	
06338848 A	December 1994	JPX	

ART-UNIT: 276

PRIMARY-EXAMINER: Lee; Benjamin C.

ATTY-AGENT-FIRM: Frohwitter

## ABSTRACT:

There is disclosed an information reporting system comprising a communication host apparatus including a database storing a plurality of data sets each concerning predetermined position, and a host computer, and at least one portable terminal including a data processing unit for executing predetermined processing based upon data received from a communication unit via a communication networks, and a display unit displaying images obtained by the data processing. The portable terminal further includes a current position detecting unit for detecting its current position, and is adapted to transmit position information data indicative of the current position. The host computer is responsive to read out from the database one of the data sets concerning the position corresponding to the provided position information data and supplies the portable terminal with the data set.

10 Claims, 14 Drawing figures

**WEST**[Help](#)[Logout](#)[Interrupt](#)[Main Menu](#)[Search Form](#)[Posting Counts](#)[Show S Numbers](#)[Edit S Numbers](#)[Preferences](#)[Cases](#)**Search Results -**

Terms	Documents
4630209.pn.	3

Database:

US Patents Full-Text Database  
 US Pre-Grant Publication Full-Text Database  
 JPO Abstracts Database  
 EPO Abstracts Database  
 Derwent World Patents Index  
 IBM Technical Disclosure Bulletins

Search:

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**DATE: Monday, March 11, 2002**   [Printable Copy](#)   [Create Case](#)
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*DB=USPT,PGPB,JPAB,EPAB,DWPI,TDBD; PLUR=YES; OP=OR*

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<u>L9</u>	4773026.pn.	1	<u>L9</u>
<u>L8</u>	5592665.pn.	1	<u>L8</u>
<u>L7</u>	5544060.pn.	1	<u>L7</u>
<i>DB=USPT,PGPB,JPAB,EPAB,DWPI,TDBD; PLUR=YES; OP=OR</i>			
<u>L6</u>	L3 and kd-tree or peano	127	<u>L6</u>
<u>L5</u>	L4	3	<u>L5</u>
<u>L4</u>	L3 and (sub-areas or subareas)	3	<u>L4</u>
<u>L3</u>	L2 and (parcel or section)	270	<u>L3</u>
<u>L2</u>	L1 and map and database	638	<u>L2</u>
<u>L1</u>	((701/200  701/201  701/202  701/203  701/204  701/205  701/206  701/207  701/208  701/209  701/210  701/211  701/212  701/213 )!.CCLS. )	3165	<u>L1</u>

END OF SEARCH HISTORY

**WEST**

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L6: Entry 6 of 127

File: USPT

Jan 1, 2002

US-PAT-NO: 6336111

DOCUMENT-IDENTIFIER: US 6336111 B1

TITLE: Support for alternative names in a geographic database used with a navigation program and methods for use and formation thereof

DATE-ISSUED: January 1, 2002

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ashby; Richard A.	Blue River	WI	53518	
Lampert; David S.	Highland Park	IL	60035	

APPL-NO: 9/ 504976 [PALM]

DATE FILED: February 15, 2000

## PARENT-CASE:

REFERENCE TO RELATED APPLICATION The present application is a continuation of Ser. No. 09/019,684 filed Feb. 6, 1998, now U.S. Pat. No. 6,081,803.

INT-CL: [7] G06 F 17/30

US-CL-ISSUED: 707/4; 707/100, 701/208

US-CL-CURRENT: 707/4; 701/208, 707/100

FIELD-OF-SEARCH: 707/104.4, 707/1-6, 707/100, 701/200, 701/201, 701/208, 701/213, 701/209, 340/990, 340/995

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected

Search ALL



	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/>	<u>4888698</u>	December 1989	Driessen et al.	701/200
<input type="checkbox"/>	<u>4907159</u>	March 1990	Mauge et al.	701/117
<input type="checkbox"/>	<u>5214793</u>	May 1993	Conway et al.	455/500
<input type="checkbox"/>	<u>5465088</u>	November 1995	Braegas	340/905
<input type="checkbox"/>	<u>5487002</u>	January 1996	Diller et al.	701/1
<input type="checkbox"/>	<u>5543789</u>	August 1996	Behr et al.	340/995
<input type="checkbox"/>	<u>5784691</u>	July 1998	Ruhl	455/186.1
<input type="checkbox"/>	<u>5797112</u>	August 1998	Komatsu et al.	701/201
<input type="checkbox"/>	<u>5835854</u>	November 1998	Palisson et al.	455/186.1
<input type="checkbox"/>	<u>5864305</u>	January 1999	Rosenquist	340/905
<input type="checkbox"/>	<u>6081803</u>	June 2000	Ashby et al.	707/4

## FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
411219105	August 1999	JPX	

ART-UNIT: 2172

PRIMARY-EXAMINER: Alam; Hosain T.

## ABSTRACT:

A method and system for supporting alternative names of geographic locations with a navigation application program that uses a geographic database stored on a computer-readable medium. The alternative names of geographic locations include names in a plurality of different languages. Included are one or more language filters. Each of the one or more language filters associates the data records in the geographic database that are used as names for geographic locations with one or more of the plurality of different languages. A routine uses the one or more language filters so that the navigation application program can use names for geographic locations that are valid in an access language selected from among the plurality of different languages.

14 Claims, 13 Drawing figures

**WEST**

Generate Collection

Print

L6: Entry 8 of 127

File: USPT

Oct 23, 2001

US-PAT-NO: 6308177

DOCUMENT-IDENTIFIER: US 6308177 B1

TITLE: System and method for use and storage of geographic data on physical media

DATE-ISSUED: October 23, 2001

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Israni; Vijaya S.	Hoffman Estates	IL	60195	
Ashby; Richard A.	Hebron	IL	60034	
Nyczak; Gregory M.	Westmont	IL	60559	
Smith; Nicholas E.	Oak Park	IL	60302	

APPL-NO: 9/ 362947 [PALM]

DATE FILED: July 28, 1999

## PARENT-CASE:

REFERENCE TO RELATED APPLICATIONS The present application is a divisional of Ser. No. 08/740,295, now U.S. Pat. No. 5,968,109, filed Oct. 25, 1996, and is related to the copending application entitled "INTERFACE LAYER FOR NAVIGATION SYSTEM", U.S. Pat. No. 5,047,280, filed on Oct. 25, 1996, assigned to the assignee of the present application, and the entire disclosure of which is incorporated herein by reference.

INT-CL: [7] G06 F 17/30

US-CL-ISSUED: 707/100; 701/207, 701/208, 340/990

US-CL-CURRENT: 707/100; 340/990, 701/207, 701/208

FIELD-OF-SEARCH: 707/100, 701/207, 701/208, 340/990

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected

Search ALL

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/>	<u>4086632</u>	April 1978	Lions	701/210
<input type="checkbox"/>	<u>4630209</u>	December 1986	Saito et al.	701/201
<input type="checkbox"/>	<u>4888698</u>	December 1989	Driessen et al.	701/200
<input type="checkbox"/>	<u>4937572</u>	June 1990	Yamada et al.	340/995
<input type="checkbox"/>	<u>4970652</u>	November 1990	Nagashima	701/208
<input type="checkbox"/>	<u>4972319</u>	November 1990	DeLorme	340/990
<input type="checkbox"/>	<u>5029125</u>	July 1991	Sciupac	707/205
<input type="checkbox"/>	<u>5036471</u>	July 1991	Tamura et al.	340/209
<input type="checkbox"/>	<u>5150295</u>	September 1992	Mattingly	702/5
<input type="checkbox"/>	<u>5168452</u>	December 1992	Yamada et al.	701/208
<input type="checkbox"/>	<u>5170353</u>	December 1992	Verstraete	702/5
<input type="checkbox"/>	<u>5285391</u>	February 1994	Smith, Jr. et al.	701/202
<input type="checkbox"/>	<u>5295261</u>	March 1994	Simonetti	701/202
<input type="checkbox"/>	<u>5359527</u>	October 1994	Takanabe	701/200
<input type="checkbox"/>	<u>5367671</u>	November 1994	Feigenbaum et al.	707/1
<input type="checkbox"/>	<u>5406493</u>	April 1995	Goto et al.	707/2
<input type="checkbox"/>	<u>5412573</u>	May 1995	Barnea et al.	701/209
<input type="checkbox"/>	<u>5592665</u>	January 1997	Lahaije	701/208
<input type="checkbox"/>	<u>5617319</u>	April 1997	Arakawa	701/207
<input type="checkbox"/>	<u>5694534</u>	December 1997	White, Jr. et al.	345/440
<input type="checkbox"/>	<u>5754846</u>	May 1998	Janse et al.	707/100
<input type="checkbox"/>	<u>5815161</u>	September 1998	Janse et al.	345/440
<input type="checkbox"/>	<u>5832406</u>	November 1998	Emmerick et al.	701/202

## FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0 306 075 A1	March 1989	EPX	
0 559 975 A1	September 1993	EPX	
0 646 882 A1	April 1995	EPX	
0 702 208 A2	March 1996	EPX	
WO 97/00425	January 1997	WOX	

## OTHER PUBLICATIONS

Matsuyama et al., "A File Organization for Geographic Information Systems Based on Spatial Proximity" Computer Vision, Graphics and Image Processing 26:303-318 (1984).  
 Frosh, Randy, "A Method of Accessing Large Spatial Data-bases", Nov. 26-30, 1989, GIS/LIS '89 Conference, Orlando, FL.  
 Samet, Hanan, "Strategies for Optimizing the Use of Redundancy in Spatial Databases", Chapter 2.4, The Design and Analysis of Spatial Data Structure, ISGN 0-201-50255-0. No Date.  
 Bentley, Jon L., "Multidimensional Binary Search Trees in Data Applications", IEEE Transactions of Software Engineering, vol. E-5, No. 4, Jul. 1979, pp. 333-340.  
 Ohnishi et al., "Map Database Generation System for In-Vehicle Navigation System",

1994 Vehicle Navigation & Information Systems Conference Proceedings. Published Aug. 31, 1994.

H. Classen et al., "GDF, A Proposed Standard for Digital Road Maps to be used in Car Navigation Systems", Proceedings of the vehicle Navigation and Information Systems Conference. (VNIS Sep. 11-13, 1989) Toronto, Canada, pp. 324-330.

ART-UNIT: 271

PRIMARY-EXAMINER: Black; Thomas

ASSISTANT-EXAMINER: Trinh; William

ABSTRACT:

An improved method and system for storage of geographic data on physical storage media. The geographic data are stored in a manner that facilitates and enhances use and access of the data by various navigation application functions in navigation systems that use the data. The geographic data includes a parcelization that separates the geographic data into parcels having less than or equal to a maximum parcel size but having at least a desired fill percentage. The parcelization method also provides for a division arrangement that facilitates addressing and identification of the parcels. According to a further aspect, the geographic data includes special nodal entities that are used to collapse complex intersections, such as roundabouts, cloverleaves, and divided highways, into simpler data representations. The special nodal entities are associated with road segment data entities and used in a route calculation program in place of regular node entities. Further, the geographic data include a normalized attribute array that includes reoccurring combinations of certain selected attributes of the geographic data. Indices to the array are included in place of data corresponding to the selected attributes. When a navigation application program requests data, an entry in the normalized attribute table pointed to by an index in the data is used to return the requested data in the particular combination of attributes from the normalized attribute array. The geographic data is compiled by a method that facilitates access to the data on a physical medium. According to the compilation method, data files to be stored on the medium are organized into parcels. The data records within the data files are identified by the parcel in which they are located. An arrangement of all the data files on the medium is determined and a parcel identification related to the medium is assigned to each parcel. Cross references between data records are updated to include the assigned parcel identifications and the parcels are stored on the medium.

20 Claims, 33 Drawing figures

**WEST**

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L6: Entry 12 of 127

File: USPT

Jun 19, 2001

US-PAT-NO: 6249742

DOCUMENT-IDENTIFIER: US 6249742 B1

TITLE: Method and system for providing a preview of a route calculated with a navigation system

DATE-ISSUED: June 19, 2001

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Friederich; Matthew	Berwyn	IL		
McDonough; William	Glen Ellyn	IL		
Ashby; Richard	Blue River	WI		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Navigation Technologies Corp.	Rosemont	IL			02

APPL-NO: 9/ 597507 [PALM]

DATE FILED: June 20, 2000

## PARENT-CASE:

REFERENCE TO RELATED APPLICATION The present application is a divisional of Ser. No. 09/368,283, filed Aug. 3, 1999, now U.S. Pat. No. 6,122,593.

INT-CL: [7] G06 G 7/78

US-CL-ISSUED: 701/202; 701/208, 701/25, 340/995

US-CL-CURRENT: 701/202; 340/995, 701/208, 701/25

FIELD-OF-SEARCH: 701/200, 701/202, 701/208, 701/23, 701/25, 701/209, 707/1, 707/100, 707/102, 707/104, 340/995

PRIOR-ART-DISCLOSED:

## U.S. PATENT DOCUMENTS

Search Selected

Search ALL

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/>	<u>5544060</u>	August 1996	Fuju et al.	364/444
<input type="checkbox"/>	<u>5559707</u>	September 1996	DeLorme et al.	364/443
<input type="checkbox"/>	<u>5953722</u>	September 1999	Lampert et al.	707/100

ART-UNIT: 361

PRIMARY-EXAMINER: Cuchlinski, Jr.; William A.

ASSISTANT-EXAMINER: Beaulieu; Yonel

ATTY-AGENT-FIRM: Kozak; Frank J. Kaplan; Lawrence M.

## ABSTRACT:

A navigation system uses a geographic database to determine a solution route to a destination and provides detailed maneuvering guidance for following the solution route. In addition, the navigation system includes a preview function that provides a summary of the solution route prior to providing the detailed maneuvering guidance for following the solution route. The preview function is included in the programming of the navigation system. The preview function uses a feature incorporated in the geographic database wherein the portion of the geographic database used by the navigation system when determining a solution route includes references to another portion of the database that includes the actual text of the names of the roads represented thereby. As the navigation system uses the data in the geographic database to determine the solution route, data representing the roads in the solution route are saved, including the references to the other portion of the geographic database that includes the actual text of the names of the roads. After the solution route is determined, the preview function evaluates the data representing the roads in the solution route and provides a list of route preview data structures. The list of route preview data structures includes the references to the portion of the geographic database that includes the actual text of the names of the roads. The list of route preview data structures is used to provide the user of the navigation system with a preview that contains a summary of the solution route. The preview provided to the user can include the names of the roads in the solution route. The names can be obtained from the geographic database using the references contained in the list of route preview data structures. When obtaining the names, the references can be reordered to facilitate accessing the text of the names quickly. By providing a preview of the calculated route, the user is familiarized with the route prior to being given detailed guidance for following the route.

20 Claims, 18 Drawing figures

**WEST**☐ **Generate Collection** **Print**

L6: Entry 16 of 127

File: USPT

Feb 6, 2001

US-PAT-NO: 6184823  
DOCUMENT-IDENTIFIER: US 6184823 B1

TITLE: Geographic database architecture for representation of named intersections and complex intersections and methods for formation thereof and use in a navigation application program

DATE-ISSUED: February 6, 2001

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Smith; Nicholas E.	Oak Park	IL		
Ashby; Richard A.	Blue River	WI		
Israni; Vijaya	Hoffman Estates	IL		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Navigation Technologies Corp.	Rosemont	IL			02

APPL-NO: 9/ 071721 [PALM]  
DATE FILED: May 1, 1998

INT-CL: [7] H04 B 7/185, G01 S 5/02

US-CL-ISSUED: 342/357.13; 701/208, 701/209  
US-CL-CURRENT: 342/357.13; 701/208, 701/209

FIELD-OF-SEARCH: 342/357.13, 701/208, 701/209, 340/990

PRIOR-ART-DISCLOSED:

## U.S. PATENT DOCUMENTS

☐ **Search Selected** **Search ALL**

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/>	<u>4937752</u>	June 1990	Nanba et al.	
<input type="checkbox"/>	<u>5185161</u>	February 1993	Emmerink et al.	
<input type="checkbox"/>	<u>5231584</u>	July 1993	Nimura et al.	
<input type="checkbox"/>	<u>5802492</u>	September 1998	DeLorme et al.	340/990

ART-UNIT: 362  
PRIMARY-EXAMINER: Blum; Theodore M.  
ATTY-AGENT-FIRM: Kozak; Frank J. Kaplan; Laurence M.

ABSTRACT:

An architecture for a geographic database that supports the identification and use of names for intersections of roads located in a geographic region, and methods for use and formation thereof. The geographic database includes data that represent components of a road network in a geographic region. The geographic database includes a first plurality of data entities each of which represents an intersection of roads in the road network and a second plurality of data entities each of which represents a name of one of the components of the road network. The geographic database includes a third plurality of data entities each of which associates one of the first plurality of data entities with one of the second plurality of data entities. The third plurality of data entities are referenced by other data entities in the geographic database and by indices to allow a navigation application program using the geographic database to identify intersections of roads in the geographic region by name and to use the name of an intersection for the purpose of location identification and route guidance. Also disclosed is an improved process for forming substitute data records to represent complex physical geographic features thereby facilitating operation of a navigation system by reducing processing requirements for certain functions.

34 Claims, 27 Drawing figures



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L6: Entry 17 of 127

File: USPT

Jan 9, 2001

US-PAT-NO: 6173277

DOCUMENT-IDENTIFIER: US 6173277 B1

TITLE: Interface layer for navigation system

DATE-ISSUED: January 9, 2001

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ashby; Richard A.	Hebron	IL		
Bouzide; Paul M.	Chicago	IL		
Israni; Vijaya S.	Hoffman Estates	IL		
Lampert; David S.	Highland Park	IL		
Natesan; Senthil K.	Carol Stream	IL		
Killey; Grant S.	Westmont	IL		
Jasper; John C.	Arlington Heights	IL		
Fernekes; Robert P.	Wooddale	IL		
Feigen; Jerry S.	Chicago	IL		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Navigation Technologies Corporation	Rosemont	IL			02

APPL-NO: 9/ 390737 [PALM]

DATE FILED: September 7, 1999

## PARENT-CASE:

REFERENCE TO RELATED APPLICATIONS The present application is a continuation of Ser. No. 08/740,298, filed Oct. 25, 1996, now U.S. Pat. No. 6,047,280 and is related to the copending application entitled "IMPROVED SYSTEM AND METHOD FOR USE AND STORAGE OF GEOGRAPHIC DATA ON PHYSICAL MEDIA", Ser. No. 08/740,295 now U.S. Pat. No. 5,968,109, filed on Oct. 25, 1996, assigned to the assignee of the present application, and the entire disclosure of which is incorporated herein by reference.

INT-CL: [7] G06 F 17/30, G06 T 11/20, G08 G 1/123

US-CL-ISSUED: 707/1; 701/208, 701/209, 345/440, 340/995

US-CL-CURRENT: 707/1; 340/995, 345/440, 701/208, 701/209

FIELD-OF-SEARCH: 701/201, 701/202, 701/207, 701/208, 701/209, 707/1, 707/2, 707/202, 345/440, 340/995

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

**Search Selected****Search ALL**

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/>	<u>4086632</u>	April 1978	Lions	701/210
<input type="checkbox"/>	<u>4630209</u>	December 1986	Saito et al.	701/201
<input type="checkbox"/>	<u>4888698</u>	December 1989	Driessen et al.	364/443
<input type="checkbox"/>	<u>4937572</u>	June 1990	Yamada et al.	340/995
<input type="checkbox"/>	<u>4970652</u>	November 1990	Nagashima	364/449
<input type="checkbox"/>	<u>4972319</u>	November 1990	Delorme	340/990
<input type="checkbox"/>	<u>5036471</u>	July 1991	Tamura et al.	364/449
<input type="checkbox"/>	<u>5150295</u>	September 1992	Mattingly	364/420
<input type="checkbox"/>	<u>5168452</u>	December 1992	Yamada et al.	701/202
<input type="checkbox"/>	<u>5170353</u>	December 1992	Verstraete	701/202
<input type="checkbox"/>	<u>5191532</u>	March 1993	Moroto et al.	364/449
<input type="checkbox"/>	<u>5235701</u>	August 1993	Ohler et al.	707/1
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<input type="checkbox"/>	<u>5295261</u>	March 1994	Simonetti	707/2
<input type="checkbox"/>	<u>5359527</u>	October 1994	Takanabe et al.	364/449
<input type="checkbox"/>	<u>5406493</u>	April 1995	Goto et al.	364/449
<input type="checkbox"/>	<u>5412573</u>	May 1995	Barnes et al.	364/449
<input type="checkbox"/>	<u>5517419</u>	May 1996	Lanckton et al.	364/449
<input type="checkbox"/>	<u>5528518</u>	June 1996	Bardshaw et al.	702/150
<input type="checkbox"/>	<u>5592665</u>	January 1997	Lahaije	707/4
<input type="checkbox"/>	<u>5617319</u>	April 1997	Arakawa et al.	701/207
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<input type="checkbox"/>	<u>5731978</u>	March 1998	Tamai et al.	701/201
<input type="checkbox"/>	<u>5754846</u>	May 1998	Janse	707/100
<input type="checkbox"/>	<u>5815161</u>	September 1998	Emmerink	345/440
<input type="checkbox"/>	<u>5832406</u>	November 1998	Iwami et al.	701/202
<input type="checkbox"/>	<u>5953722</u>	September 1999	Lampert et al.	707/100
<input type="checkbox"/>	<u>5968109</u>	October 1999	Israni et al.	701/208

## FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0 514 972 A2	May 1992	EPX	
0 715 250 A2	November 1995	EPX	
WO 96/06326	February 1996	WOX	

## OTHER PUBLICATIONS

Lee, Single Line Street Network: The Foundation of Mobile GIS, IEEE, pp. 34-37, (1993). \*

Clementini, A Spatial Data Model Undrelying Human Interaction with Object Oriented

Spatial Databases, IEEE, pp. 110-117, (1991).\*

Masatoshi Arikawa, Personal Dynamic Maps Based on Distributed Geographic Information Servers, IEEE, pp. 591-596, (1994).\*

Jordan, Dawn of a New Era: The Image Information Age, IEEE, pp. 2238-2230, (1996).\*

Frosh, Randy. "A Method of Accessing Large Spatial Databases", Nov. 26-30, 1989, GIS/LIS '89 Conference, Orlando, Florida.

Samet, Hanan. "Strategies for Optimizing the Use of Redundancy in Spatial Databases", Chapter 2.4, The Design and Analysis of Spatial Data Structure, ISBN 0-201-50255-0, No Date.

Bentley, Jon L. "Multidimensional Binary Search Trees in Data Applications", IEEE Transactions on Software Engineering, vol. SE-5, No. 4, Jul. 1979, pp. 333-40.

Declaration Regarding Toolkit Software by Vijaya Israni, No Date.

ART-UNIT: 271

PRIMARY-EXAMINER: Black; Thomas G.

ASSISTANT-EXAMINER: Coby; Frantz

ATTY-AGENT-FIRM: Kozak; Frank J. Kaplan; Lawrence M.

#### ABSTRACT:

An improved method and system that provides for a data access interface layer in a navigation system. The navigation system is of the type that includes a navigation application software program that provides navigating features to a user of the system and a geographic database stored on a computer-readable storage medium wherein the geographical database includes information relating to the geographical region about which the navigation system provides the navigation features to the user. The data access interface layer is preferably stored in the navigation system as a library of software functions. The data access interface layer operates in conjunction with the navigation system application software. The data access interface layer isolates the navigation application software from the geographic data which are stored on the storage medium. The data access interface layer intercepts requests by the navigation application software for geographic data. The data access interface layer retrieves geographic data from the storage medium and converts the data into a format usable by the navigation application software. The data access interface layer also provides for memory management that facilitates accessing and using geographic data from the particular storage medium quickly and efficiently. By recognizing that different media types have different physical formats, the data access interface layer accommodates and isolates the differences so that the portions of the data access interface layer that interact with the navigation application software can be generic.

31 Claims, 9 Drawing figures

**WEST**

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L6: Entry 21 of 127

File: USPT

Sep 19, 2000

US-PAT-NO: 6122593

DOCUMENT-IDENTIFIER: US 6122593 A

TITLE: Method and system for providing a preview of a route calculated with a navigation system

DATE-ISSUED: September 19, 2000

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Friederich; Matthew	Berwyn	IL		
McDonough; William	Glen Ellyn	IL		
Ashby; Richard	Blue River	WI		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Navigation Technologies Corporation	Rosemont	IL			02

APPL-NO: 9/ 368283 [PALM]

DATE FILED: August 3, 1999

INT-CL: [7] G06 F 17/00

US-CL-ISSUED: 701/202; 701/200, 701/208, 701/209, 701/23, 701/25, 707/1, 707/100, 707/104

US-CL-CURRENT: 701/202; 701/200, 701/208, 701/209, 701/23, 701/25, 707/1, 707/100, 707/104.1

FIELD-OF-SEARCH: 701/200, 701/202, 701/208, 701/23, 701/25, 701/209, 707/1, 707/100, 707/102, 707/104, 340/995

PRIOR-ART-DISCLOSED:

## U.S. PATENT DOCUMENTS

☐ Search Selected☐ Search ALL

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/>	<u>5544060</u>	August 1996	Fuju et al.	364/444
<input type="checkbox"/>	<u>5559707</u>	September 1996	DeLorne et al.	364/443
<input type="checkbox"/>	<u>5953722</u>	September 1999	Lampert et al.	707/100

ART-UNIT: 361

PRIMARY-EXAMINER: Cuchlinski, Jr.; William A.

ASSISTANT-EXAMINER: Beaulieu; Yonel

ATTY-AGENT-FIRM: Kozak; Frank J. Kaplan; Lawrence M.

**ABSTRACT:**

A navigation system uses a geographic database to determine a solution route to a destination and provides detailed maneuvering guidance for following the solution route. In addition, the navigation system includes a preview function that provides a summary of the solution route prior to providing the detailed maneuvering guidance for following the solution route. The preview function is included in the programming of the navigation system. The preview function uses a feature incorporated in the geographic database wherein the portion of the geographic database used by the navigation system when determining a solution route includes references to another portion of the database that includes the actual text of the names of the roads represented thereby. As the navigation system uses the data in the geographic database to determine the solution route, data representing the roads in the solution route are saved, including the references to the other portion of the geographic database that includes the actual text of the names of the roads. After the solution route is determined, the preview function evaluates the data representing the roads in the solution route and provides a list of route preview data structures. The list of route preview data structures includes the references to the portion of the geographic database that includes the actual text of the names of the roads. The list of route preview data structures is used to provide the user of the navigation system with a preview that contains a summary of the solution route. The preview provided to the user can include the names of the roads in the solution route. The names can be obtained from the geographic database using the references contained in the list of route preview data structures. When obtaining the names, the references can be reordered to facilitate accessing the text of the names quickly. By providing a preview of the calculated route, the user is familiarized with the route prior to being given detailed guidance for following the route.

20 Claims, 18 Drawing figures

**WEST**

Generate Collection

Print

L6: Entry 23 of 127

File: USPT

Aug 29, 2000

US-PAT-NO: 6112200

DOCUMENT-IDENTIFIER: US 6112200 A

TITLE: Interleaving of data types in a geographic database and methods for application

DATE-ISSUED: August 29, 2000

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Livshutz; Michael	Niles	IL		
Israni; Vijaya S.	Hoffman Estates	IL		
Ashby; Richard A.	Blue River	WI		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE	CODE
Navigation Technologies Corporation	Rosemont	IL				02

APPL-NO: 9/ 039586 [PALM]

DATE FILED: March 16, 1998

## PARENT-CASE:

REFERENCE TO RELATED APPLICATION The present application is related to the copending application entitled "SEGMENT AGGREGATION IN A GEOGRAPHIC DATABASE AND METHODS FOR USE THEREOF IN A NAVIGATION APPLICATION" filed on even date herewith, the entire disclosure of which is incorporated by reference herein.

INT-CL: [7] G06 F 17/30

US-CL-ISSUED: 707/4; 707/100, 707/200, 701/201, 701/206, 701/208, 701/214, 711/157, 711/173

US-CL-CURRENT: 707/4; 701/201, 701/206, 701/208, 701/214, 707/100, 707/200, 711/157, 711/173

FIELD-OF-SEARCH: 707/4, 707/100, 707/200, 701/214, 701/208, 701/201, 701/206, 711/157, 711/173

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected

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<input type="checkbox"/>	<u>4888698</u>	December 1989	Driessen et al.	701/200
<input type="checkbox"/>	<u>4926336</u>	May 1990	Yamada	364/444
<input type="checkbox"/>	<u>4954959</u>	September 1990	Moroto et al.	364/449
<input type="checkbox"/>	<u>4972319</u>	November 1990	Delorme	340/990
<input type="checkbox"/>	<u>4984168</u>	January 1991	Neukrichner et al.	364/449
<input type="checkbox"/>	<u>5031104</u>	July 1991	Ikeda et al.	364/449
<input type="checkbox"/>	<u>5036471</u>	July 1991	Tamura et al.	364/449
<input type="checkbox"/>	<u>5168452</u>	December 1992	Yamada et al.	364/444
<input type="checkbox"/>	<u>5285391</u>	February 1994	Smith, Jr. et al.	364/443
<input type="checkbox"/>	<u>5408597</u>	April 1995	Kita et al.	395/140
<input type="checkbox"/>	<u>5440730</u>	August 1995	Elmasri et al.	707/203
<input type="checkbox"/>	<u>5502640</u>	March 1996	Yagyu et al.	364/443
<input type="checkbox"/>	<u>5513110</u>	April 1996	Fujita et al.	364/449
<input type="checkbox"/>	<u>5515284</u>	May 1996	Abe	364/444
<input type="checkbox"/>	<u>5519619</u>	May 1996	Seda	364/444
<input type="checkbox"/>	<u>5528501</u>	June 1996	Hanson	364/443
<input type="checkbox"/>	<u>5537323</u>	July 1996	Schulte	364/449
<input type="checkbox"/>	<u>5710915</u>	January 1998	McElhiney	707/3
<input type="checkbox"/>	<u>5754846</u>	May 1998	Janse et al.	707/100
<input type="checkbox"/>	<u>5893898</u>	April 1999	Tanimoto	701/201

ART-UNIT: 277

PRIMARY-EXAMINER: Homere; Jean R.

ATTY-AGENT-FIRM: Kozak; Frank J. Kaplan; Lawrence M.

## ABSTRACT:

A geographic database for use with a navigation application program that provides navigation features to an end-user. The geographic database includes a plurality of data records of a first type and a plurality of data records of a second type. The plurality of records of the first type are organized into a plurality of parcels, each of which includes a plurality of data records of the first type and the plurality of records of the second type are organized into a plurality of parcels, each of which includes a plurality of data records of the second type. The parcels of data records of the first type are interleaved with the parcels of data records of the second type. This interleaving enables navigation functions that use these different types to access these different types more quickly and efficiently, thereby enhancing navigation system performance. Also disclosed is a method for forming a geographic database that includes a plurality of data records that represent geographic features and which can be used in a navigation system. The method includes the step of interleaving parcels containing pluralities of data records of a first type with parcels containing pluralities of data records of a second type.

24 Claims, 23 Drawing figures

**WEST**

Generate Collection

Print

L6: Entry 24 of 127

File: USPT

Jun 27, 2000

US-PAT-NO: 6081803

DOCUMENT-IDENTIFIER: US 6081803 A

TITLE: Support for alternative names in a geographic database used with a navigation program and methods for use and formation thereof

DATE-ISSUED: June 27, 2000

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ashby; Richard A.	Blue River	WI		
Lampert; David S.	Highland Park	IL		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Navigation Technologies Corporation	Rosemont	IL			02

APPL-NO: 9/ 019684 [PALM]

DATE FILED: February 6, 1998

INT-CL: [7] G06 F 17/30

US-CL-ISSUED: 707/4; 707/100, 704/8, 340/990, 340/995

US-CL-CURRENT: 707/4; 340/990, 340/995, 704/8, 707/100

FIELD-OF-SEARCH: 707/1-3, 707/4, 707/200, 707/100, 704/8.2, 704/2-4, 704/7, 701/209, 701/200-201, 701/208, 701/213, 340/990, 340/995

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected

Search ALL



	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/>	<u>4888698</u>	December 1989	Drissen et al.	701/200
<input type="checkbox"/>	<u>4907159</u>	March 1990	Mauge et al.	701/117
<input type="checkbox"/>	<u>5214793</u>	May 1993	Conway et al.	455/500
<input type="checkbox"/>	<u>5465088</u>	November 1995	Braegas	340/905
<input type="checkbox"/>	<u>5487002</u>	January 1996	Diller et al.	701/1
<input type="checkbox"/>	<u>5543789</u>	August 1996	Behr et al.	340/995
<input type="checkbox"/>	<u>5784691</u>	July 1998	Ruhl	455/186.1
<input type="checkbox"/>	<u>5797112</u>	August 1998	Komatsu et al.	701/201
<input type="checkbox"/>	<u>5835854</u>	November 1998	Palisson et al.	455/186.1
<input type="checkbox"/>	<u>5864305</u>	September 1999	Rosenquist	340/905

ART-UNIT: 271

PRIMARY-EXAMINER: Alam; Hosain T.

ATTY-AGENT-FIRM: Kozak; Frank J. Kaplan; Lawrence M.

## ABSTRACT:

A method and system for supporting alternative names of geographic locations with a navigation application program that uses a geographic database stored on a computer-readable medium. The alternative names of geographic locations include names in a plurality of different languages. Included are one or more language filters. Each of the one or more language filters associates the data records in the geographic database that are used as names for geographic locations with one or more of the plurality of different languages. A routine uses the one or more language filters so that the navigation application program can use names for geographic locations that are valid in an access language selected from among the plurality of different languages.

12 Claims, 13 Drawing figures

**WEST**

Generate Collection

Print

L6: Entry 25 of 127

File: USPT

Jun 6, 2000

US-PAT-NO: 6073076

DOCUMENT-IDENTIFIER: US 6073076 A

TITLE: Memory management for navigation system

DATE-ISSUED: June 6, 2000

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Crowley; Paul	Buffalo Grove	IL		
Jaugilas; John	Lombaro	IL		
Nash; Alex	Gurnee	IL		
Natesan; Senthil	Carol Stream	IL		
Lampert; David S.	Highland Park	IL		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE	CODE
Navigation Technologies Corporation	Rosemont	IL				02

APPL-NO: 9/ 049747 [PALM]

DATE FILED: March 27, 1998

INT-CL: [7] G06 F 17/30

US-CL-ISSUED: 701/208; 707/102

US-CL-CURRENT: 701/208; 707/102

FIELD-OF-SEARCH: 707/1, 707/5, 707/10, 707/100-104, 707/200-206, 701/208

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected

Search ALL

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/>	<u>4876651</u>	October 1989	Dawson et al.	364/449
<input type="checkbox"/>	<u>5101357</u>	March 1992	Tempelhof	364/449
<input type="checkbox"/>	<u>5781195</u>	July 1998	Marvin	345/428
<input type="checkbox"/>	<u>5848373</u>	October 1999	DeLorme	701/200
<input type="checkbox"/>	<u>5867110</u>	February 1999	Naito et al.	340/995
<input type="checkbox"/>	<u>5893901</u>	April 1999	Maki	704/260
<input type="checkbox"/>	<u>5953722</u>	September 1999	Lampert et al.	707/100
<input type="checkbox"/>	<u>5966135</u>	October 1999	Roy et al.	345/433
<input type="checkbox"/>	<u>5968109</u>	October 1999	Israni et al.	701/208
<input type="checkbox"/>	<u>5978730</u>	November 1999	Poppen et al.	701/202
<input type="checkbox"/>	<u>6016485</u>	January 2000	Amakawa et al.	705/400

ART-UNIT: 271

PRIMARY-EXAMINER: Ho; Ruay Lian

ATTY-AGENT-FIRM: Kozak; Frank J. Kaplan; Lawrence M.

## ABSTRACT:

A method and system for managing memory resources in a system used in conjunction with a navigation application program that accesses geographic data. The geographic data are comprised of a plurality of data records. The plurality of data records are organized into parcels, each of which contains a portion of the plurality of data records, such that the data records in each portion of the plurality of data records that forms each parcel are accessed together. One or more buffers each that forms a contiguous portion of the memory of the navigation system is provided as a cache to store a plurality of parcels. One or more data structures located outside the contiguous portion of memory identify the parcels of data stored in the cache and the locations in the cache at which the parcels are stored. The one or more data structures located outside the contiguous portion of memory in which the parcels are cached are used to manage the parcel cache to use it efficiently. These one or more data structures located outside the contiguous memory in which the parcels are cached are also used to defragment the parcel cache.

29 Claims, 14 Drawing figures

**WEST**

Generate Collection

Print

L6: Entry 27 of 127

File: USPT

Apr 4, 2000

US-PAT-NO: 6047280

DOCUMENT-IDENTIFIER: US 6047280 A

TITLE: Interface layer for navigation system

DATE-ISSUED: April 4, 2000

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ashby; Richard A.	Hebron	IL		
Bouzide; Paul M.	Chicago	IL		
Israni; Vijaya S.	Hoffman Estates	IL		
Lampert; David S.	Highland Park	IL		
Natesan; Senthil K.	Carol Stream	IL		
Killey; Grant S.	Westmont	IL		
Jasper; John C.	Arlington Heights	IL		
Fernekes; Robert P.	Wooddale	IL		
Feigen; Jerry S.	Chicago	IL		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Navigation Technologies Corporation	Rosemont	IL			02

APPL-NO: 8/ 740298 [PALM]

DATE FILED: October 25, 1996

## PARENT-CASE:

REFERENCE TO RELATED APPLICATIONS The present application is related to the cop ending application entitled "IMPROVED SYSTEM AND METHOD FOR USE AND STORAGE OF GEOGRAPHIC DATA ON PHYSICAL MEDIA", Ser. No. 08/740,295, now pending, assigned to the assignee of the present application, filed on even date herewith, the entire disclosure of which is incorporated by reference herein.

INT-CL: [7] G06 F 17/30

US-CL-ISSUED: 707/2; 707/104, 340/988, 340/990, 340/995, 701/200, 701/208, 701/209, 701/211

US-CL-CURRENT: 707/2; 340/988, 340/990, 340/995, 701/200, 701/208, 701/209, 701/211

FIELD-OF-SEARCH: 340/988, 340/990, 340/995, 701/200, 701/208, 701/209, 701/211, 707/2, 707/104

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected

Search ALL

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/>	<u>4086632</u>	April 1978	Lions	701/210
<input type="checkbox"/>	<u>4630209</u>	December 1986	Saito et al.	701/201
<input type="checkbox"/>	<u>4888698</u>	December 1989	Driessen et al.	701/200
<input type="checkbox"/>	<u>4937572</u>	June 1990	Yamada et al.	340/995
<input type="checkbox"/>	<u>4970652</u>	November 1990	Nagashima	701/208
<input type="checkbox"/>	<u>4972319</u>	November 1990	Delorme	340/990
<input type="checkbox"/>	<u>5036471</u>	July 1991	Tamura et al.	701/209
<input type="checkbox"/>	<u>5150295</u>	September 1992	Mattingly	702/5
<input type="checkbox"/>	<u>5168452</u>	December 1992	Yamada et al.	701/202
<input type="checkbox"/>	<u>5170353</u>	December 1992	Verstraete	701/202
<input type="checkbox"/>	<u>5235701</u>	August 1993	Ohler et al.	707/1
<input type="checkbox"/>	<u>5285391</u>	February 1994	Smith, Jr. et al.	701/200
<input type="checkbox"/>	<u>5295261</u>	March 1994	Simonetti	707/2
<input type="checkbox"/>	<u>5359527</u>	October 1994	Takanabe et al.	701/209
<input type="checkbox"/>	<u>5406493</u>	April 1995	Goto et al.	701/208
<input type="checkbox"/>	<u>5412573</u>	May 1995	Barnea et al.	701/211
<input type="checkbox"/>	<u>5592665</u>	January 1997	Lahaije	707/4
<input type="checkbox"/>	<u>5617319</u>	April 1997	Arakawa et al.	701/207
<input type="checkbox"/>	<u>5694534</u>	December 1997	White, Jr.	345/440
<input type="checkbox"/>	<u>5754846</u>	May 1998	Janse	707/100
<input type="checkbox"/>	<u>5815161</u>	September 1998	Emmerink	345/440
<input type="checkbox"/>	<u>5832406</u>	November 1998	Iwami et al.	701/202

## OTHER PUBLICATIONS

Frosh, Randy. "A Method of Accessing Large Spatial Databases", Nov. 26-30, 1989, GIS/LIS '89 Conference, Orlando, Florida.

Samet, Hanan. "Strategies for Optimizing the Use of Redundancy in Spatial Databases", Chapter 2.4, The Design and Analysis of Spatial Data Structure, ISBN 0-201-50255-0.

Bentley, Jon L.. "Multidimensional Binary Search Trees in Data Applications", IEEE Transactions on Software Engineering, vol. SE-5, No. 4, Jul. 1979, pp. 333-340.

Declaration Regarding Toolkit Software by Vijaya Israni.

ART-UNIT: 271

PRIMARY-EXAMINER: Lintz; Paul R.

ATTY-AGENT-FIRM: Kozak; Frank J. Kaplan; Lawrence M.

## ABSTRACT:

An improved method and system that provides for a data access interface layer in a navigation system. The navigation system is of the type that includes a navigation application software program that provides navigating features to a user of the system and a geographic database stored on a computer-readable storage medium wherein the geographical database includes information relating to the geographical region about which the navigation system provides the navigation features to the user. The data access interface layer is preferably stored in the navigation system as a library of software functions. The data access interface layer operates in

conjunction with the navigation system application software. The data access interface layer isolates the navigation application software from the geographic data which are stored on the storage medium. The data access interface layer intercepts requests by the navigation application software for geographic data. The data access interface layer retrieves geographic data from the storage medium and converts the data into a format usable by the navigation application software. The data access interface layer also provides for memory management that facilitates accessing and using geographic data from the particular storage medium quickly and efficiently. By recognizing that different media types have different physical formats, the data access interface layer accommodates and isolates the differences so that the portions of the data access interface layer that interact with the navigation application software can be generic.

50 Claims, 9 Drawing figures

**WEST**

Generate Collection

Print

L6: Entry 28 of 127

File: USPT

Mar 14, 2000

US-PAT-NO: 6038559

DOCUMENT-IDENTIFIER: US 6038559 A

TITLE: Segment aggregation in a geographic database and methods for use thereof in a navigation application

DATE-ISSUED: March 14, 2000

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ashby; Richard A.	Blue River	WI		
Bouzide; Paul M.	Chicago	IL		
Doddapaneni; Srinivasa	Chicago	IL		
Fernekes; Robert P.	Cary	IL		
Friederich; Matthew	Berwyn	IL		
Israni; Vijaya S.	Hoffman Estates	IL		
Jasper; John C.	Arlington Heights	IL		
Kavakh; Asta	Lake Zurich	IL		
McDonough; William	Glen Ellyn	IL		
Meek; James A.	Palatine	IL		
Natesan; Senthil K.	Carol Stream	IL		
Smith; Nicholas E.	Oak Park	IL		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Navigation Technologies Corporation	Rosemont	IL			02

APPL-NO: 9/ 039583 [PALM]

DATE FILED: March 16, 1998

INT-CL: [7] G06 F 17/30

US-CL-ISSUED: 707/4; 707/100, 707/200, 701/201, 701/206, 701/208, 701/214, 711/157, 711/173

US-CL-CURRENT: 707/4; 701/201, 701/206, 701/208, 701/214, 707/100, 707/200, 711/157, 711/173

FIELD-OF-SEARCH: 707/4, 707/100, 707/200, 701/214, 701/208, 701/201, 701/206, 711/157, 711/173

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

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	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
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<input type="checkbox"/>	<u>4926336</u>	May 1990	Yamada	364/444
<input type="checkbox"/>	<u>4954959</u>	September 1990	Moroto et al.	364/449
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<input type="checkbox"/>	<u>5285391</u>	February 1994	Smith, Jr. et al.	364/443
<input type="checkbox"/>	<u>5408597</u>	April 1995	Kita et al.	395/140
<input type="checkbox"/>	<u>5440730</u>	August 1995	Elmasri et al.	707/203
<input type="checkbox"/>	<u>5502640</u>	March 1996	Yagyu et al.	364/443
<input type="checkbox"/>	<u>5513110</u>	April 1996	Fujita et al.	364/449
<input type="checkbox"/>	<u>5515284</u>	May 1996	Abe	364/444
<input type="checkbox"/>	<u>5519619</u>	May 1996	Seda	364/444
<input type="checkbox"/>	<u>5528501</u>	June 1996	Hanson	364/443
<input type="checkbox"/>	<u>5537323</u>	July 1996	Schulte	364/449
<input type="checkbox"/>	<u>5710915</u>	January 1998	McElhiney	707/3
<input type="checkbox"/>	<u>5754846</u>	May 1998	Janse et al.	707/100
<input type="checkbox"/>	<u>5893898</u>	April 1999	Tanimoto	701/201

## FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0 838 661 A2	April 1998	EPX	
WO 98/27534	June 1998	WOX	

ART-UNIT: 277

PRIMARY-EXAMINER: Kulik; Paul V.

ASSISTANT-EXAMINER: Corriellus; Jean M.

ATTY-AGENT-FIRM: Kozak; Frank J. Kaplan; Larry M.

## ABSTRACT:

A geographic database for use with a navigation application program that provides navigation features to an end-user. The geographic database includes data entities that represent segments of roads and additionally includes data entities that represent aggregations of segments of roads. The data entities that represent aggregations of segments of roads are used during a route calculation by the navigation application to suppress evaluation of roads of lesser functional rank thereby enhancing performance of the navigation system. According to one aspect, each of the data entities that represent segments of roads that represents a segment of a road that together with at least one other segment of a road forms part of an aggregation which is represented by one of the data entities that represent aggregations of segments of roads includes a reference thereto. According to another aspect, each of the data entities that represent aggregations of segments of roads refers to data entities that are abbreviated representations of the segments of



roads included in the represented aggregation. Each of the data entities that are abbreviated representations of the segments of roads refers to a corresponding one of the data entities that represent segments of roads that represents the same respective segment of road. According to this aspect, at least some of the data entities that represent aggregations of segments of roads are stored separately from the data entities that are abbreviated representations of the segments of roads included in the represented aggregation. According to a further aspect, the navigation application program uses the references between the data entities that represent segments of roads, the data entities that represent aggregations of segments of roads, and the data entities that are abbreviated representations of the segments of roads included in the represented aggregation to provide navigation features, including evaluating which data entities to use for route calculation and ascertaining whether a solution route has been found.

20 Claims, 26 Drawing figures

**WEST**

Generate Collection

Print

L6: Entry 32 of 127

File: USPT

Oct 26, 1999

US-PAT-NO: 5974419

DOCUMENT-IDENTIFIER: US 5974419 A

TITLE: Parcelization of geographic data for storage and use in a navigation application

DATE-ISSUED: October 26, 1999

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ashby, Richard A.	Blue River	WI		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE	CODE
Navigation Technologies Corporation	Rosemont	IL				02

APPL-NO: 8/ 924328 [PALM]  
DATE FILED: September 5, 1997

## PARENT-CASE:

REFERENCE TO RELATED APPLICATIONS The present application is a continuation-in-part of Ser. No. 08/740,295 and Ser. No. 08/740,298, both filed Oct. 25, 1996, both now pending, the entire disclosures of which are incorporated by reference herein.

INT-CL: [6] G06 F 17/36

US-CL-ISSUED: 707/100; 707/104, 701/200, 701/201, 701/202, 701/209, 340/990, 340/995, 340/996

US-CL-CURRENT: 707/100; 340/990, 340/995, 340/996, 701/200, 701/201, 701/202, 701/209, 707/104.1

FIELD-OF-SEARCH: 707/100, 707/104, 701/200, 701/201, 701/202, 701/209, 340/990, 340/995, 340/996

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

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<input type="checkbox"/>	<u>4888698</u>	December 1989	Driessen et al.	701/200
<input type="checkbox"/>	<u>4937572</u>	June 1990	Yamada et al.	340/995
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<input type="checkbox"/>	<u>5170353</u>	December 1992	Verstraete	701/202
<input type="checkbox"/>	<u>5285391</u>	February 1994	Smith, Jr. et al.	701/200
<input type="checkbox"/>	<u>5406493</u>	April 1995	Goto et al.	701/200
<input type="checkbox"/>	<u>5592665</u>	January 1997	Lahaije	707/4
<input type="checkbox"/>	<u>5754846</u>	May 1998	Janse et al.	707/100

## OTHER PUBLICATIONS

Frosh, Randy, "A Method of Accessing Large Spatial Databases", Nov. 26-30, 1989, GIS/LIS '89 Conference, Orlando, Florida.  
Samet, Hanan, "Strategies for Optimizing the Use of Redundancy in Spatial Databases", Chapter 2.4, The Design and Analysis of Spatial Data Structure, ISBN 0-201-50255-0; (before 1996).  
Bentley, Jon L, "Multidimensional Binary Search Trees in Data Applications", IEEE Transactions on Software Engineering, vol. SE-5, No. 4, Jul. 1979, pp. 333-340.

ART-UNIT: 271

PRIMARY-EXAMINER: Lintz; Paul R.

ATTY-AGENT-FIRM: Kozak; Frank J. Kaplan; Lawrence M.

## ABSTRACT:

A system and method for arranging and storing a plurality of records of geographic data, wherein each record corresponds to a physical feature having a physical location in a geographic region. The method and system comprise arranging the records of geographic data into a plurality of parcels. Each parcel includes records of geographic data that represent features having physical locations encompassed within a corresponding associated rectangular area located in the geographic region. The size and location of each such rectangular area associated with a parcel is determined by a series of divisions of a bounding rectangle that encompasses all of the features represented by the plurality of records into further rectangular areas. Each division, subsequent to an initial division, is made on a rectangular area resulting from the preceding division. Each such division of a rectangular area is made at a location along the rectangular area based upon an assessment of one or more trial divisions of the rectangular area at one or more locations. A division is selected based upon a comparison of the quantities of data encompassed by the rectangular area and each of the further rectangular areas formed by the one or more trial divisions. The assessment is based upon a comparison of these quantities of data for each such trial division to a plurality of ranges of acceptable data quantities. These acceptable sizes are derived from a desired fill percentage of parcels with data.

20 Claims, 15 Drawing figures

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L6: Entry 33 of 127

File: USPT

Oct 19, 1999

US-PAT-NO: 5968109

DOCUMENT-IDENTIFIER: US 5968109 A

TITLE: System and method for use and storage of geographic data on physical media

DATE-ISSUED: October 19, 1999

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Israni; Vijaya S.	Hoffman Estates	IL		
Ashby; Richard A.	Hebron	IL		
Bouzide; Paul M.	Chicago	IL		
Jasper; John C.	Arlington Heights	IL		
Fernekes; Robert P.	Wooddale	IL		
Nyczak; Gregory M.	Westmont	IL		
Smith; Nicholas E.	Oak Park	IL		
Lampert; David S.	Highland Park	IL		
Meek; James A.	Palatine	IL		
Crane; Aaron I.	Palatine	IL		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Navigation Technologies Corporation	Rosemont	IL			02

APPL-NO: 8/ 740295 [PALM]

DATE FILED: October 25, 1996

## PARENT-CASE:

REFERENCE TO RELATED APPLICATIONS The present application is related to "INTERFACE LAYER FOR NAVIGATION SYSTEM", Ser. No. 08/740,298, assigned to the assignee of the present application, filed on even date herewith, and the entire disclosure of which is incorporated by reference herein.

INT-CL: [6] G01 C 21/00

US-CL-ISSUED: 701/208; 707/102

US-CL-CURRENT: 701/208; 707/102

FIELD-OF-SEARCH: 701/208, 701/200, 340/995, 707/102, 707/104

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected

Search ALL

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/> <u>4086632</u>	April 1978	Lions	364/444
<input type="checkbox"/> <u>4630209</u>	December 1986	Saito et al.	364/444
<input type="checkbox"/> <u>4888698</u>	December 1989	Driessen et al.	364/443
<input type="checkbox"/> <u>4937572</u>	June 1990	Yamada et al.	340/995
<input type="checkbox"/> <u>4970652</u>	November 1990	Nagashima	364/449
<input type="checkbox"/> <u>4972319</u>	November 1990	Delorme	364/419
<input type="checkbox"/> <u>5036471</u>	July 1991	Tamura et al.	364/449
<input type="checkbox"/> <u>5150295</u>	September 1992	Mattingly	364/420
<input type="checkbox"/> <u>5168452</u>	December 1992	Yamada et al.	364/444
<input type="checkbox"/> <u>5170353</u>	December 1992	Verstraete	364/444
<input type="checkbox"/> <u>5285391</u>	February 1994	Smith, Jr. et al.	364/443
<input type="checkbox"/> <u>5295261</u>	March 1994	Simonetti	395/600
<input type="checkbox"/> <u>5359527</u>	October 1994	Takanabe	364/449
<input type="checkbox"/> <u>5406493</u>	April 1995	Goto et al.	364/449
<input type="checkbox"/> <u>5412573</u>	May 1995	Barnea et al.	364/449
<input type="checkbox"/> <u>5592665</u>	January 1997	Lahaije	395/604
<input type="checkbox"/> <u>5617319</u>	April 1997	Arakawa	364/449
<input type="checkbox"/> <u>5694534</u>	December 1997	White, Jr. et al.	395/140
<input type="checkbox"/> <u>5754846</u>	May 1998	Janse et al.	395/611
<input type="checkbox"/> <u>5815161</u>	September 1998	Emmerink et al.	345/440
<input type="checkbox"/> <u>5832406</u>	November 1998	Iwami	701/202

## OTHER PUBLICATIONS

Matsuyama et al., "A File Organization for Geographic Information Systems Based on Spatial Proximity", Computer Vision, Graphics, and Image Processing 26, 303-318 (1984).

Frosh, Randy, "A Method of Accessing Large Spatial Databases", Nov. 26-30, 1989, GIS/LIS '89 Conference, Orlando, Florida.

Samet, Hanan, "Strategies for Optimizing the Use of Redundancy in Spatial Databases", Chapter 2.4, The Design and Analysis of Spatial Data Structure, ISBN 0-201-50255-0. No Date.

Bentley, Jon L, "Multidimensional Binary Search Trees in Data Applications", IEEE Transactions of Software Engineering, vol. SE-5, No. 4, Jul. 1979, pp. 333-340.

ART-UNIT: 361

PRIMARY-EXAMINER: Zanelli; Michael J.

ATTY-AGENT-FIRM: Kozak; Frank J. Kaplan; Lawrence M.

## ABSTRACT:

An improved method and system for storage of geographic data on physical storage media. The geographic data are stored in a manner that facilitates and enhances use and access of the data by various navigation application functions in navigation systems that use the data. The geographic data includes a parcelization that separates the geographic data into parcels having less than or equal to a maximum parcel size but having at least a desired fill percentage. The parcelization method also provides for a division arrangement that facilitates addressing and identification of the parcels. According to a further aspect, the geographic data

includes special nodal entities that are used to collapse complex intersections, such as roundabouts, cloverleaves, and divided highways, into simpler data representations. The special nodal entities are associated with road segment data entities and used in a route calculation program in place of regular node entities. Further, the geographic data include a normalized attribute array that includes reoccurring combinations of certain selected attributes of the geographic data. Indices to the array are included in place of data corresponding to the selected attributes. When a navigation application program requests data, an entry in the normalized attribute table pointed to by an index in the data is used to return the requested data in the particular combination of attributes from the normalized attribute array. The geographic data is compiled by a method that facilitates access to the data on a physical medium. According to the compilation method, data files to be stored on the medium are organized into parcels. The data records within the data files are identified by the parcel in which they are located. An arrangement of all the data files on the medium is determined and a parcel identification related to the medium is assigned to each parcel. Cross references between data records are updated to include the assigned parcel identifications and the parcels are stored on the medium.

59 Claims, 33 Drawing figures

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L6: Entry 37 of 127

File: USPT

Sep 14, 1999

US-PAT-NO: 5953722

DOCUMENT-IDENTIFIER: US 5953722 A

TITLE: Method and system for forming and using geographic data

DATE-ISSUED: September 14, 1999

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Lampert; David S.	Highland Park	IL		
Ashby; Richard A.	Blue River	WI		

## ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE	CODE
Navigation Technologies Corporation	Rosemont	IL				02

APPL-NO: 8/ 935809 [PALM]

DATE FILED: September 5, 1997

## PARENT-CASE:

REFERENCE TO RELATED APPLICATIONS The present application is a continuation-in-part of Ser. No. 08/740,295 and Ser. No. 08/740,298, both filed Oct. 25, 1996, the entire disclosures of which are incorporated by reference herein.

INT-CL: [6] G06 F 17/30

US-CL-ISSUED: 707/100; 707/104, 707/2, 701/200, 701/201, 701/208, 701/209

US-CL-CURRENT: 707/100; 701/200, 701/201, 701/208, 701/209, 707/104.1, 707/2

FIELD-OF-SEARCH: 701/200, 701/201, 701/208, 701/209, 707/100, 707/104, 707/2

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected

Search ALL

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/> 4630209	December 1986	Saito et al.	
<input type="checkbox"/> 4888698	December 1989	Driessen et al.	
<input type="checkbox"/> 4937572	June 1990	Yamada et al.	
<input type="checkbox"/> 5036471	July 1991	Tamura et al.	
<input type="checkbox"/> 5168452	December 1992	Yamada et al.	
<input type="checkbox"/> 5170353	December 1992	Verstraete	
<input type="checkbox"/> 5285391	February 1994	Smith, Jr. et al.	
<input type="checkbox"/> 5406493	April 1995	Goto et al.	
<input type="checkbox"/> 5592665	January 1997	Lahaije	395/604

## OTHER PUBLICATIONS

Matsuyama et al., "A File Organization for Geographic Information Systems Based on Spatial Proximity", Computer Vision, Graphics, and Image Processing, vol. 26, No. 3, Jun. 26, 1984, 0. 303-318.

Frosh, Randy, "A Method of Accessing Large Spatial Databases", Nov. 26-30, 1989, GIS/LIS '89 Conference, Orlando, Florida.

Samet, Hanan, "Strategies for Optimizing the Use of Redundancy in Spatial Databases", Chapter 2.4, The Design and Analysis of Spatial Data Structure, ISBN 0-201-50255-0; (before 1996).

Bentley, Jon L, "Multidimensional Binary Search Trees in Data Applications", IEEE Transactions on Software Engineering, vol. SE-5, No. 4, Jul. 1979, pp. 333-340.

ART-UNIT: 271

PRIMARY-EXAMINER: Lintz; Paul R.

ATTY-AGENT-FIRM: Kozak; Frank J. Kaplan; Lawrence M.

## ABSTRACT:

A system and method for making and using a geographic database. The geographic database represents a geographic region and is used with a navigation application program. The geographic database includes a plurality of data entities each of which represents a physical feature in the geographic region. The plurality of data entities are separated into a plurality of parcels each of which contains a grouping of data entities that represent features in the geographic area encompassed within a separate one of a plurality of rectangles which together encompass all the features in the entire geographic region represented by all of the plurality of data entities. Each of the plurality of data entities has a data entity ID. The data entities contained in each of the plurality of parcels define an associated range of data entity ID's associated with their respective parcel such that the range of data entity ID's associated with each parcel does not overlap the range of data entity ID's associated with any another of the plurality of parcels. Associated with the geographic database is a searchable kd-tree structure whose nodes represent divisions of the geographic region into the rectangles from which the parcels are formed. The kd-tree structure permits spatial searching for a parcel based upon geographic coordinates. The kd-tree also includes data at certain of its nodes that identify the ranges of data entity ID's included in parcels formed from rectangles resulting from the divisions thereby enabling the kd-tree to be used as a binary tree for performing searches using the data entity ID's. Navigation application program functions can search for data by utilizing the kd-tree to conduct either a spatial search using geographic coordinates or a binary search using a data entity ID.

23 Claims, 27 Drawing figures